

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

YUJI ARIYOSHI

Application No. Unassigned

Art Unit: Unassigned

Filed: February 26, 2002

Examiner: Unassigned

For: FLOW MEASURING APPARATUS

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D. C. 20231

Dear Sir:

Prior to the examination of the above-identified patent application, please enter the following amendments and consider the following remarks.

IN THE CLAIMS

Replace the indicated claims with:

1. (Amended) A flow measuring apparatus for measuring flow of a fluid based on a difference in radiation of heat at an upstream side and at a downstream side of a heating member located in the flow of the fluid, comprising:

a heating member;

an upstream temperature sensor located at an upstream side of the heating member for measuring a first temperature;

a downstream temperature sensor located at a downstream side of the heating member for measuring a second temperature; and

a circuit for controlling power supplied to the heating member to maintain an average temperature of the first temperature measured by the upstream temperature sensor and the second temperature measured by the downstream temperature sensor at a fixed temperature.

3. (Amended) The flow measuring apparatus according to claim 1, further comprising:

an upstream heating member located between the heating member and the upstream temperature sensor for generating heat based on power supplied to the upstream heating member and controlled by the circuit; and

a downstream heating member located between the heating member and the downstream temperature sensor for generating heat based on power supplied to the downstream heating member and controlled by the circuit, wherein the circuit controls the power supplied to the upstream heating member and to the downstream heating member to maintain the first temperature measured by the upstream temperature sensor and the second temperature measured by the downstream temperature sensor substantially equal and the flow of the fluid is measured based on the difference between the respective powers.

4. (Amended) The flow measuring apparatus according to claim 1, wherein the circuit modifies the fixed temperature based on temperature of the fluid.

5. (Amended) The flow measuring apparatus according to claim 1, wherein the circuit modifies the fixed temperature based on the flow of the fluid.

6. (Amended) A flow measuring apparatus for measuring flow of a fluid based on a difference in radiation of heat at an upstream side and at a downstream side of a heating member located in the flow of the fluid, comprising:

first, second, third, fourth, fifth, and sixth thermally sensitive resistors located in a row from an upstream side to a downstream side, each resistor generating heat and sensing temperature; and

a circuit for controlling power supplied to each of the thermally sensitive resistors, wherein the circuit controls respective powers supplied to the third and the fourth thermally sensitive resistors to maintain temperatures of the second and the fifth thermally sensitive resistors substantially equal, said circuit controls respective powers supplied to the second and the fifth thermally sensitive resistors to maintain temperatures of the first and the sixth thermally sensitive resistors substantially equal, and said circuit measures the flow of the fluid based on the difference between the respective powers supplied to the third and the fourth thermally sensitive resistors and the difference between the respective powers supplied to the second and the fifth thermally sensitive resistors.

7. (Amended) The flow measuring apparatus according to claim 6, further comprising a heating resistor located between the third and the fourth thermally sensitive resistors, wherein the circuit controls power supplied to the heating resistor to maintain an average temperature of the first and the sixth thermally sensitive resistors at a fixed temperature.

8. (Amended) The flow measuring apparatus according to claim 7, wherein the circuit modifies the fixed temperature based on temperature of the fluid.

IN THE ABSTRACT

Replace the abstract with:

ABSTRACT OF THE DISCLOSURE

A fluid flow measuring method and apparatus with high sensitivity, quick response, and a wide dynamic range measures the flow of a fluid based on a difference in radiation of heat at an upstream side and a downstream side of a heating member located in the flow of the fluid. The apparatus includes a heating member; an upstream temperature sensor located on the upstream side of the heating member for measuring a first temperature; a downstream temperature sensor located on the downstream side of the

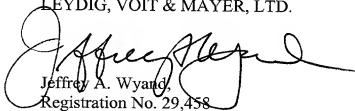
heating member for measuring a second temperature; and a circuit for controlling power supplied to the heating member to maintain an average temperature of the first temperature measured by the upstream temperature sensor and the second temperature measured by the downstream temperature sensor at a fixed temperature.

REMARKS

The foregoing amendments are made to correct minor translational errors and to meet United States requirements as to form. No new matter is added.

Respectfully submitted,

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AMENDMENTS TO SPECIFICATION, CLAIMS, AND
ABSTRACT MADE VIA PRELIMINARY AMENDMENT

Amendments to existing claims:

1. (Amended) A flow measuring apparatus for measuring flow of a fluid based on a difference in radiation of heat ~~between~~ at an upstream side and at a downstream side of a heating member ~~provided~~ located in the flow of the fluid, comprising:

a heating member;

an upstream temperature sensor ~~provided on the~~ located at an upstream side of the heating member for measuring a first temperature;

a downstream temperature sensor ~~provided on the~~ located at a downstream side of the heating member for measuring a second temperature; and

a circuit for controlling power supplied to the heating member to maintain an average temperature ~~level~~ of the first temperature measured by the upstream temperature sensor and the second temperature measured by the downstream temperature sensor at ~~a predetermined level~~ fixed temperature.

3. (Amended) The flow measuring apparatus according to claim 1, further comprising:

an upstream heating member ~~provided~~ located between the heating member and the upstream temperature sensor for generating heat based on ~~the~~ the power supplied to the upstream heating member and controlled by the circuit; and

a downstream heating member ~~provided~~ located between the heating member and the downstream temperature sensor for generating heat based on ~~the~~ the power supplied to the downstream heating member and controlled by the circuit, wherein the circuit controls ~~respective~~ the power supplied to the upstream heating member and to the downstream heating member to maintain the first temperature measured by the upstream temperature sensor and the second temperature measured by the downstream temperature sensor substantially equal and ~~measures~~ the flow of the fluid is measured based on the difference between the respective ~~power~~ powers.

4. (Amended) The flow measuring apparatus according to ~~claims~~ claim 1, wherein the circuit modifies the ~~predetermined level~~ fixed temperature based on temperature of the fluid.

5. (Amended) The flow measuring apparatus according to ~~claims~~ claim 1, wherein the circuit modifies the ~~predetermined level~~ fixed temperature based on the flow of the fluid.

6. (Amended) ~~The~~ A flow measuring apparatus for measuring flow of a fluid based on a difference in radiation of heat ~~between at an upstream side and at a downstream side of a heating member~~ provided located in the flow of the fluid, comprising:

~~a first, a second, a third, a fourth, a fifth, and a sixth~~ thermally sensitive resistors ~~provided~~ located in a row from an upstream side to a downstream side, each resistor ~~having functions as a heater for generating heat and as a temperature sensor for measuring~~ sensing temperature; and

a circuit for controlling power supplied to each of the thermally sensitive ~~resistor to heat resistors~~, wherein the circuit controls respective ~~power powers~~ supplied to the third and the fourth thermally sensitive resistors to maintain ~~heated temperature levels~~ temperatures of the second and the fifth thermally sensitive resistors substantially equal, said circuit controls respective ~~power powers~~ supplied to the second and the fifth thermally sensitive resistors to maintain ~~heated temperature levels~~ temperatures of the first and the sixth thermally sensitive resistors substantially equal, and said circuit measures the flow of the fluid based on the difference between the respective ~~power powers~~ supplied to the third and the fourth thermally sensitive resistors and the difference between the respective ~~power powers~~ supplied to the second and the fifth thermally sensitive resistors.

7. (Amended) The flow measuring apparatus according to claim 6, further comprising: a heating resistor ~~provided~~ located between the third and the fourth thermally sensitive resistors, wherein the circuit controls power supplied to the heating resistor to maintain an average temperature ~~level~~ of the first and the sixth thermally sensitive resistors at a ~~predetermined level~~ fixed temperature.

8. (Amended) The flow measuring apparatus according to claim 7, wherein the circuit modifies the ~~predetermined level~~ fixed temperature based on temperature of the fluid.

Amendments to the abstract:

ABSTRACT OF THE DISCLOSURE

A fluid flow measuring method ~~is provided which is~~ and apparatus with high ~~in~~ the sensitivity and the quick response, and a wide ~~in the~~ dynamic range. A flow measuring apparatus measures the flow of a fluid based on a difference in radiation of heat ~~between at~~ an upstream side and a downstream side of a heating member ~~provided located~~ in the flow of the fluid. The apparatus includes a heating member; an upstream temperature sensor ~~provided located~~ on the upstream side of the heating member for

measuring a first temperature; a downstream temperature sensor ~~provided~~ located on the downstream side of the heating member for measuring a second temperature; and a circuit for controlling power supplied to the heating member to maintain an average temperature ~~level~~ of the first temperature measured by the upstream temperature sensor and the second temperature measured by the downstream temperature sensor at a ~~predetermined level~~ fixed temperature.

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PENDING CLAIMS AFTER ENTRY OF PRELIMINARY AMENDMENT

1. A flow measuring apparatus for measuring flow of a fluid based on a difference in radiation of heat at an upstream side and at a downstream side of a heating member located in the flow of the fluid, comprising:
 - a heating member;
 - an upstream temperature sensor located at an upstream side of the heating member for measuring a first temperature;
 - a downstream temperature sensor located at a downstream side of the heating member for measuring a second temperature; and
 - a circuit for controlling power supplied to the heating member to maintain an average temperature of the first temperature measured by the upstream temperature sensor and the second temperature measured by the downstream temperature sensor at a fixed temperature.
2. The flow measuring apparatus according to claim 1, wherein the flow of the fluid is calculated from the difference between the first temperature measured by the upstream temperature sensor and the second temperature measured by the downstream temperature sensor.

3. The flow measuring apparatus according to claim 1, further comprising:
an upstream heating member located between the heating member and the upstream temperature sensor for generating heat based on power supplied to the upstream heating member and controlled by the circuit; and
a downstream heating member located between the heating member and the downstream temperature sensor for generating heat based on power supplied to the downstream heating member and controlled by the circuit, wherein the circuit controls the power supplied to the upstream heating member and to the downstream heating member to maintain the first temperature measured by the upstream temperature sensor and the second temperature measured by the downstream temperature sensor substantially equal and the flow of the fluid is measured based on the difference between the respective powers.

4. The flow measuring apparatus according to claim 1, wherein the circuit modifies the fixed temperature based on temperature of the fluid.

5. The flow measuring apparatus according to claim 1, wherein the circuit modifies the fixed temperature based on the flow of the fluid.

6. A flow measuring apparatus for measuring flow of a fluid based on a difference in radiation of heat at an upstream side and at a downstream side of a heating member located in the flow of the fluid, comprising:

first, second, third, fourth, fifth, and sixth thermally sensitive resistors located in a row from an upstream side to a downstream side, each resistor generating heat and sensing temperature; and

a circuit for controlling power supplied to each of the thermally sensitive resistors, wherein the circuit controls respective powers supplied to the third and the fourth thermally sensitive resistors to maintain temperatures of the second and the fifth thermally sensitive resistors substantially equal, said circuit controls respective powers supplied to the second and the fifth thermally sensitive resistors to maintain temperatures of the first and the sixth thermally sensitive resistors substantially equal, and said circuit measures the flow of the fluid based on the difference between the

respective powers supplied to the third and the fourth thermally sensitive resistors and the difference between the respective powers supplied to the second and the fifth thermally sensitive resistors.

7. The flow measuring apparatus according to claim 6, further comprising a heating resistor located between the third and the fourth thermally sensitive resistors, wherein the circuit controls power supplied to the heating resistor to maintain an average temperature of the first and the sixth thermally sensitive resistors at a fixed temperature.

8. The flow measuring apparatus according to claim 7, wherein the circuit modifies the fixed temperature based on temperature of the fluid.